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# Vascular Flora of the University of Central Oklahoma Selman Living Living Laboratory, Woodward County, Oklahoma

Robin R. Buckallew<sup>1</sup> and Gloria M. Caddell

Department of Biology, University of Central Oklahoma, Edmond, OK 73034

<sup>1</sup> Current address: University of North Texas Institute of Applied Sciences, Denton, TX

**The vascular flora of the University of Central Oklahoma Selman Living Laboratory (SLL) was surveyed from 1999 to 2003. The SLL is a 129.5 ha biological field station located in the Cimarron Gypsum Hills in Woodward County, Oklahoma. We identified 229 species in 61 families. The three families with the largest numbers of species were the Asteraceae (48), Poaceae (45), and Fabaceae (14). Two hundred eight species (91%) are native, and 156 (68%) are perennial. Fifty-six species were identified that previously had not been reported for Woodward County. Flowering/fruitleting dates and habitat types for each species also are provided. Two species are classified as obligate gypsophiles. Seven riparian or floodplain species are characteristic of alkaline or saline habitats. General descriptions of the plant communities are provided. ©2003 Oklahoma Academy of Science**

## INTRODUCTION

We conducted a floristic survey to determine the vascular plant composition of the University of Central Oklahoma (UCO) Selman Living Laboratory (SLL), a biological field station located in the Cimarron Gypsum Hills of northwestern Oklahoma. The major vegetation types in this part of Oklahoma are Mixed Grass Eroded Plains and Sandsage Grassland (Duck and Fletcher 1943). The SLL supports primarily mixed-grass prairie and gypsum outcrop communities, with some areas of sandsage grassland. The vegetation of the gypsum outcrops was of particular interest because gypsum provides a unique habitat for plant species. This was noted by Stevens and Shannon (1917), who listed several species found on gypsum in Oklahoma that were usually not found on other substrates. Johnston (1941) noted that gypsum generally had been overlooked by plant ecologists as a special habitat for plants. He categorized plants that were restricted to gypsum soils as obligate gypsophiles, and those found on non-gypsum as well as gypsum soils as gypsum-tolerant. Parsons (1976) refers to the latter as facultative gypsophiles. Bruner (1931) characterized the

Gypsum Hills as belonging to the mixed-grass prairie, but did not describe the vegetation of the gypsum outcrops. Barber (1974, 1979) conducted a study of the vegetation of the Mangum Gypsum hills and redbed plains of southwestern Oklahoma. She found 108 species on gypsum, including seven obligate gypsophiles and six gypsum indicators (those occurring only occasionally on non-gypsum substrates). No study has documented the vegetation of the Cimarron Gypsum Hills.

The objectives of this study were to inventory the vascular flora of the SLL, document flowering and fruiting dates for each species, and record the habitat(s) within which each species was found. This survey, conducted in the years immediately following removal of cattle, will serve as a baseline study of the flora at the SLL. It also provides the first published floristic inventory of an area within the Cimarron Gypsum Hills in northwestern Oklahoma.

### Study area

The SLL covers 129.5 ha and is located in Woodward County (36°41'7"N, 99°16'38"W; T26N, R19W, SE 1/4 of Section 31, and SW

1/4 of Section 32). It is in the temperate steppe ecoregion (Bailey 1998). The climate is semi-arid, with annual precipitation of approximately 61-66 cm. The wettest months are May and June, and the driest are December, January, and February. The growing season lasts 189-196 d, from mid-April to mid-October. The mean annual temperature is 14°C, with temperatures remaining above 32°C for about 80-89 d. Mean monthly temperature ranges from a low of 0°C in January to a high of 27°C in July. (Oklahoma Climatological Survey 2003)

Elevations at the SLL range from 511 to 560 m above mean sea level (United States Geological Survey 1971). Steep escarpments and canyons are found on the site. The soils belong to the Vernon-Cottonwood Association, and are predominantly shallow loam or clay loam formed from gypsum ( $\text{CaSO}_4 \cdot \text{H}_2\text{O}$ ) and clay. The Cottonwood soils contain areas of exposed bare gypsum (United States Department of Agriculture Soil Conservation Service 1963). These gypsum outcrops cover roughly half of the SLL (Buckallew 2002) and belong to the Permian Blaine formation (Bozeman 2002). The Selman Cave System is located within this formation, and numerous cave entrances exist on the site. Cave waters, with high concentrations of dissolved solids, calcium carbonate, and chloride (Black 1971), flow into Salt Creek, providing a saline and slightly alkaline habitat for plant species. Although the majority of the SLL is covered with mixed-grass prairie and gypsum outcrop communities, the topography, cave entrances, and the creek provide other habitats: floodplain, cave entrance, aquatic, and riparian. A small area around a gas well on the west side of the property is disturbed.

The SLL was part of the Selman Ranch, and had been grazed by cattle for decades at an approximate density of 1 per 8 ha (J. Rankin, Selman Ranch, personal communication). Mrs. Betty Selman donated the property to UCO in 1998, and the cattle were removed in December of that year to allow the property to return to a more natural state.

## METHODS

This survey was conducted primarily during the growing seasons of 1999 and 2000. We visited the site at 2-3-wk intervals beginning in early March and recorded all species, the habitat(s) in which they occurred, their abundance in each habitat, and flowering and fruiting dates. Several species were added to this list during occasional visits to the site during 2001-2003. References used for specimen identification included Gleason (1952), Waterfall (1969), Hitchcock (1971), Correll and Correll (1975), Nelson and Couch (1985), Great Plains Flora Association (1986), G. Hoggard (1998), R. Hoggard (1998), Tyrl et al (1998), and Diggs et al (1999). Some species identifications were confirmed by comparison with specimens at the Oklahoma State University Herbarium (OKLA) and the Botanical Research Institute of Texas (BRIT). Species names and authorities follow the Integrated Taxonomic Information System (2001) and the National PLANTS Database (United States Department of Agriculture, Natural Resources Conservation Service 2002). Each species was identified as native or introduced, and as annual, biennial, or perennial, according to Taylor and Taylor (1994). Voucher specimens of all but ten species were deposited in the University of Central Oklahoma (CSU) herbarium. Those not collected include species for which a single or very few individuals were encountered (*Anemone caroliniana*, *Argemone polyanthemus*, *Asclepias tuberosa*, *Oxalis stricta*), cacti that were documented by photographs (*Opuntia macrorhiza*, *Escobaria missouriensis* var. *similis*), and a few easily-recognized species (*Celtis laevigata* var. *reticulata*, *Conyza canadensis*, *Elymus submuticus*, *Populus deltoides*).

Species were recorded as being present on gypsum outcrops, at cave entrances, in the grassland, or in riparian or aquatic habitats. Areas of the grassland dominated by *Artemisia filifolia* were recorded as sandsage grassland. The floodplain was dominated by grasses as well as *Baccharis salicina* and we recorded this as floodplain grassland.

We compared our species list for gypsum outcrops to that of Barber (1974) and to habitat descriptions in the Great Plains Flora Association (1986) to determine whether species were obligate gypsophiles or gypsum-tolerant. We checked the rarity rankings of all taxa in the Oklahoma Natural Heritage Inventory's (2003) Working List of Rare Oklahoma Plants.

## RESULTS AND DISCUSSION

We identified 229 plant species from 61 families (Appendix 1). The three families with the largest numbers of species were the Asteraceae (48), Poaceae (45), and Fabaceae (14). Together, these families represent 47% of the species identified. All other families were represented by eight or fewer species. Of the 229 species, 208 were native, and 21 (9%) were introduced. One hundred fifty-six species (68%) were perennials, including 134 perennial herbs, 10 shrubs, nine trees, one herbaceous perennial vine, and two woody vines. Common names in Appendix 1 are from Taylor and Taylor (1994); in the few cases where a common name was not listed in that reference, the common name in the National PLANTS Database (United States Department of Agriculture, National Resources Conservation Service 2002) was used.

Flowering and/or fruiting dates are presented in Appendix 1. The earliest species to flower were *Draba reptans*, *Lesquerella gordonii*, and *Ulmus americana* on or by 31 March. The earliest in fruit was *Ulmus americana* on 8 April. *Samolus ebracteatus* and *Senecio ridellii* were found in flower as late as 15 November. The numbers of species in flower per month were as follows: March, 3; April, 47; May, 130; June, 132; July, 116; August, 98; September, 74; October, 19; and November, 2. Some species flower and/or fruit only briefly, and because our trips to the property were 2-3-wk apart, it was not possible to observe all species in both their flowering and fruiting conditions. The flowering/fruiting dates should be taken as only an approximation of the reproductive period for each species.

The habitat type(s) in which each species was found are listed in Appendix 1.

There were 92 species growing on gypsum outcrops, 164 in the grassland, 75 in sandsage grassland, 56 in the floodplain, 51 at cave entrances, and 59 in the riparian zone. Abundance data for each species are reported in Buckallew (2002).

On the gypsum outcrops, common species in April were *Castilleja purpurea* var. *citrina* and *Lesquerella gordonii*. As the growing season progressed the following species were commonly encountered: *Calylophus* spp., *Hymenopappus tenuifolius*, *Nama stevensii*, *Phacelia integrifolia*, *Polygala alba*, *Psilostrophe tagetina* var. *cerifera*, *Thelesperma magapotamicum*, *Paronychia jamesii*, *Aristida purpurea*, *Bouteloua curtipendula*, *Heterotheca stenophylla*, *Mentzelia nuda* var. *stricta*, *Portulaca pilosa*, and *Schizachyrium scoparium*. All dominants on gypsum outcrops were native. Eight species were restricted to gypsum outcrops at the SLL, but only two of these (*Phacelia integrifolia* and *Nama stevensii*) are considered obligate gypsophiles (Barber 1979). The others (*Comandra umbellata*, *Echinocereus reichenbachii*, *Opuntia macrorhiza*, *Portulaca pilosa*, *Verbena bracteata*, and *Yucca glauca*) can be found on other gravelly, rocky, sandy, or well-drained substrates (Great Plains Flora Association 1986). Five species that occurred on gypsum (*Astragalus missouriensis*, *Astragalus lotiflorus*, *Asclepias engelmanniana*, *Penstemon cf. fendleri*, *Psilostrophe tagetina* var. *cerifera*) were considered gypsum indicators by Barber (1974, 1979), although they occurred on grassland as well as gypsum outcrops at the SLL. Therefore, with the exception of *Phacelia integrifolia* and *Nama stevensii*, the species on gypsum at the SLL should be considered gypsum-tolerant. As noted by Parsons (1976), only a small percentage of species of gypsum plant communities are usually confined to gypsum.

The grassland at the SLL is mixed-grass prairie, with some areas covered by native perennial grasses such as *Andropogon gerardii*, *Andropogon hallii*, *Schizachyrium scoparium*, and *Buchloe dactyloides*. However, the impact of grazing is evident as much of the grassland was covered in the spring by introduced annual brome grasses (*Bromus* spp.) and in the summer to fall by *Bothriochloa laguroides* ssp. *torreyana* and

*Ambrosia psilostachya*, *Amphiachyris dracunculoides* and *Gutierrezia sarothrae*, which also increase with grazing (Tyrl et al 2002), were abundant in some areas. *Artemisia ludoviciana*, *Astragalus gracilis*, *Calylophus* spp., and *Psoraleidum tenuiflorum* were some other common forbs associated with the grassland. Thickets of *Rhus aromatica*, *R. glabra*, and *Prunus angustifolia* occurred in places.

The sandsage grassland was characterized by *Artemisia filifolia*. Common grasses in the spring included *Bromus* spp., and in the summer to fall *Bothriochloa laguroides* ssp. *torreyana*, *Bouteloua curtipendula*, and *Schizachyrium scoparium*. *Ambrosia psilostachya* was a common forb in the fall. Other associated forbs were *Cirsium undulatum*, *Erigeron strigosus*, *Gaura coccinea*, *Psoraleidum tenuiflorum*, and *Pyrrhopappus grandiflorus*.

*Baccharis salicina* was a common shrub in the floodplain. Commonly encountered grasses included *Bothriochloa laguroides* ssp. *torreyana*, *Bromus* spp., *Distichlis spicata*, *Elymus virginicus*, *Panicum virgatum*, *Paspalum smithii*, *Polypogon monspeliensis*, and *Sporobolus texanus*. *Ambrosia psilostachya* was common in the floodplain in the late summer to fall, and *Artemisia filifolia* also occurred here. Three of these floodplain species (*Baccharis salicina*, *Distichlis spicata*, *Sporobolus texanus*) are characteristic of saline or alkaline habitats (Great Plains Flora Association 1986).

*Tamarix chinensis*, *Salix nigra*, *Juniperus virginiana*, and *Ulmus americana* were the predominant woody plants in the riparian zone along Salt Creek. *Flaveria campestris*, *Cissus trifoliata*, *Eleocharis montevidensis*, *Pluchea odorata*, *Rorippa nasturtium-aquaticum*, *Schoenoplectus pungens* var. *pungens*, *Schoenoplectus maritimus*, *Symphotrichum divaricatum*, and *Typha domingensis* were abundant in places. Of these, *Pluchea odorata*, *Schoenoplectus maritimus*, *Symphotrichum divaricatum*, and *Typha domingensis* are characteristic of alkaline or saline habitats (Great Plains Flora Association 1986). Although seven species were recorded growing in Salt Creek, only two (*Rorippa nasturtium-aquaticum* and *Zanichellia palustris*) are classified as aquatic plants (Great Plains Flora Association 1986).

Both of these, as well as *Schoenoplectus pungens* var. *pungens* and *Typha domingensis*, are listed as obligate wetland species in Oklahoma (United States Department of Agriculture, National Resources Conservation Service 2002).

Several species occurred only at or near the entrances to caves, including *Cheilanthes feei*, *Pellaea atropurpurea* var. *atropurpurea*, *Descurainia pinnata*, *Parietaria pennsylvanica*, *Muhlenbergia racemosa*, *Phalaris caroliniana*, and *Viola bicolor*. *Ribes aureum* var. *villosum*, *Toxicodendron radicans*, and *Carex* spp. were also common near cave entrances. The ferns *C. feei* and *P. atropurpurea* var. *atropurpurea* grew attached to gypsum rock just outside the cave openings, but are not obligate gypsophiles as they can be found on other rocky substrates (Great Plains Flora Association 1986).

Of the 229 species identified in our study, 56 species appear neither in the *Atlas of the Flora of the Great Plains* (McGregor and Barkley 1977) nor in the *Atlas of the Flora of Oklahoma* database for Woodward County (Oklahoma Biological Survey 2003). Species not previously documented for Woodward County are marked with an asterisk in Appendix 1. However, their presence in Woodward County is not surprising as most are common and have been documented in surrounding counties (McGregor and Barkley 1977). Tyrl et al (2002) show many of these species distributed across northwestern Oklahoma. Their absence from lists reflects the paucity of floristic studies and collection efforts in this part of Oklahoma.

One species of cactus (*Echinocereus reichenbachii*) is imperiled in Oklahoma (state rarity rank of S2?). However, with a global rank of G5, it is demonstrably secure globally (Oklahoma Natural Heritage Inventory 2003).

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identifications of ferns; Ron Hoggard of the University of Oklahoma for identifying species of *Plantago*; and Patricia Folley of the Flora of Oklahoma Project for identifying species of *Carex*. We also thank Mrs. Betty Selman for the donation of the land that is now the SLL, and for the many ways in which she assisted us in the completion of this project. The University of Central Oklahoma Joe Jackson College of Graduate Studies and Research provided partial funding for this project through a grant to R. Buckallew. We appreciate comments by William Caire, Clark Ovrebo and Paul Stone on earlier drafts of this manuscript, as well as the constructive comments by anonymous reviewers.

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Appendix 1: Taxa present at the SLL, with origin (native, introduced), habit (annual, biennial, perennial, tree, shrub or vine), flowering and fruiting dates, and habitat (aquatic, cave entrance, floodplain, grassland, gypsum outcrop, riparian, sandsage grassland).

Taxon, Common Name, and Collection Number <sup>1</sup>	O/H <sup>2</sup>	Flower/Fruit	Habitat Type <sup>3</sup>
<b>PTERIDOPHYTA</b>			
<b>PTERIDACEAE</b>			
<i>Cheilanthes feei</i> Moore (slender lipfern) <i>RRB0844</i>	N/P	April-Oct	C
<i>Pellaea atropurpurea</i> (L.) Link (purple cliffbreak) <i>GMC0740</i>	N/P	April-Oct	C
<b>GYMNOSPERMS</b>			
<b>CUPRESSACEAE</b>			
<i>Juniperus virginiana</i> L. (eastern red cedar) <i>RRB0296</i>	N/T	April-Nov	GY, C, R
<b>MAGNOLIOPHYTA-LILIOPSIDA</b>			
<b>AGAVACEAE</b>			
<i>Yucca glauca</i> Nutt. var. <i>glauca</i> (soapweed yucca) <i>RRB0782</i>	N/P	May-June	GY
<b>COMMELINACEAE</b>			
<i>Tradescantia occidentalis</i> (Britt.) Smyth (prairie spiderwort) <i>RRB0765</i>	N/P	May-July	GR
<i>T. ohioensis</i> Raf. (Ohio spiderwort)* <i>RRB1473</i>	N/P	May-July	GR
<b>CYPERACEAE</b>			
<i>Carex aggregata</i> Mackenzie (glomerate sedge)* <i>RRB0732</i>	N/P	May-July	GR, C, FP, R
<i>C. grvida</i> Bailey var. <i>grvida</i> (heavy sedge)* <i>RRB0780</i>	N/P	May-July	GR, C, FP, R
<i>C. muehlenbergii</i> Schkuhr (Muehlenberg's sedge) <i>RRB0749</i>	N/P	May-July	GR, C, FP, R
<i>Cyperus lupulinus</i> (Spreng.) Marcks (Houghton flatsedge) <i>RRB0860</i>	N/P	June-Oct	GR, R
<i>C. odoratus</i> L. (fragrant flatsedge) <i>GMC0760</i>	N/A	June-Oct	GR, R
<i>Eleocharis montevidensis</i> Kunth (sand spikesedge) <i>RRB0731</i>	N/P	April-July	R, AQ
<i>Schoenoplectus maritimus</i> (L.) Lye (cosmopolitan bulrush) <i>RRB0606</i>	N/P	June-July	FP, R, AQ
<i>S. pungens</i> (Vahl) Palla var. <i>pungens</i> (chairmaker's bulrush) <i>RRB0378</i>	N/P	April-Sept	FP, R, AQ
<b>JUNCACEAE</b>			
<i>Juncus torreyi</i> Cov. (Torrey's rush) <i>RRB0603</i>	N/P	June-Sept	R
<b>LILIACEAE</b>			
<i>Allium drummondii</i> Regel (Drummond's wild onion) <i>RRB0301</i>	N/P	April-May	GY, GR, C
<i>Androstaphium caeruleum</i> (Scheele) Greene (blue funnel lily) <i>RRB0258</i>	N/P	April	GY, GR
<b>POACEAE</b>			
<i>Aegilops cylindrica</i> Host (jointed goatgrass) <i>RRB0799</i>	I/A	May	GR
<i>Andropogon gerardii</i> Vitman (big bluestem) <i>RRB0898</i>	N/P	Aug-Sept	GY, GR, SS, FP

\*Taxon not previously reported for Woodward County.

<sup>1</sup>RRB= Robin R. Buckallew, GMC=Gloria M. Caddell.

<sup>2</sup>O=Origin, H=Habit, N=Native, I=Introduced, P=Perennial, A=Annual, B=Biennial, V=Vine, T=Tree, S=Shrub.

<sup>3</sup>GY=Gypsum, GR=Grassland, C=Cave, SS=Sandsage, FP=Floodplain; R=Riparian, AQ=Aquatic.

Appendix 1 (contd): Taxa present at the SLL, with origin (native, introduced), habit (annual, biennial, perennial, tree, shrub or vine), flowering and fruiting dates, and habitat (aquatic, cave entrance, floodplain, grassland, gypsum outcrop, riparian, sandsage grassland).

Taxon, Common Name, and Collection Number <sup>1</sup>	O/H <sup>2</sup>	Flower/Fruit	Habitat Type <sup>3</sup>
<i>A. hallii</i> Hack. (sand bluestem) RRB0912	N/P	Aug-Sept	GY, GR, SS, FP
<i>Aristida purpurea</i> Nutt. (purple threeawn) RRB0470	N/A	May-Sept	GY, GR, SS, FP
<i>Bothriochloa ischaemum</i> (L.) Keng var. <i>songarica</i> (Rupr.) Celerier & Harlan (king ranch bluestem)* RRB0883	I/P	July-Oct	GY, GR, SS, FP
<i>B. laguroides</i> (DC.) Herter ssp. <i>torreyana</i> (Steud.) Allred & Gould (silver beardgrass) RRB0579	N/P	May-Oct	GY, GR, C, SS, FP, R
<i>Bouteloua curtipendula</i> (Michx.) Torrey (sideoats grama) RRB0852	N/P	June-Sept	GY, GR, C, SS, FP, R
<i>B. gracilis</i> (Willd. ex Kunth) Lag. ex Griffiths (blue grama) RRB0880	N/P	June-Sept	GY, GR, SS
<i>B. hirsuta</i> Lag. (hairy grama) RRB0647	N/P	June-Sept	GY, GR, SS
<i>Bromus catharticus</i> Vahl (rescuegrass)* RRB752	I/A	May	C
<i>B. cf commutatus</i> Schrad. (hairy chess)* RRB0802	I/A	May	GR
<i>B. japonicus</i> Thunb. ex Murr. (Japanese brome)* RRB0751	I/A	May-June	GR, C, SS
<i>B. tectorum</i> L. (cheatgrass) RRB0309	I/A	May-July	GY, GR, C, SS, FP, R
<i>Buchloe dactyloides</i> (Nutt.) Engelm. (buffalograss) RRB0831	N/P	May-Aug	GY, GR, C, SS, FP, R
<i>Chloris verticillata</i> Nutt. (windmill grass)* RRB0833	N/P	June-Sept	GR
<i>Dichanthelium oligosanthes</i> (J.A. Schultes) Gould var. <i>scribnerianum</i> (Nash) Gould (Scribner's panicum) RRB0806	N/P	May-July	GR, SS, FP, R
<i>Distichlis spicata</i> (L.) Greene (seashore saltgrass) RRB0804	N/P	May-Oct	GY, GR, R
<i>Echinochloa crus-galli</i> (L.) Beauv. (barnyard grass)* RRB0910	I/A	May-Oct	SS, FP, R
<i>Elymus canadensis</i> L. (Canada wild rye)* RRB0375	N/P	May-Sept	GR, C, SS, FP, R
<i>E. submuticus</i> (Hook.) Smyth & Smyth (Virginia wild rye)	N/P	May-July	FP
<i>Eragrostis spectabilis</i> (Pursh) Steud. (purple lovegrass) RRB0876	N/P	June-July	GR
<i>Erioneuron pilosum</i> (Buckl.) Nash (hairy woollygrass) RRB0468	N/P	June-July	GY, GR
<i>Hordeum jubatum</i> L. (foxtail barley) RRB0425	N/P	May-June	GR, FP, R
<i>H. pusillum</i> Nutt. (little barley)* RRB0754	I/A	May-June	GR, C, FP
<i>Muhlenbergia racemosa</i> (Michx.) B.S.P. (marsh muhly)* RRB0900	N/P	Sept-Oct	C
<i>Panicum capillare</i> L. (witchgrass)* RRB0697	N/A	Sept-Oct	R
<i>P. obtusum</i> H.B.K. (small panicgrass) RRB0485	N/P	June-Sept	GR, SS, FP, R
<i>P. virgatum</i> L. (switchgrass) RRB0873	N/P	June-Sept	GR, FP, R
<i>Pascopyrum smithii</i> (Rydb.) A. Love (western wheatgrass) RRB0839	N/P	June	FP
<i>Phalaris caroliniana</i> Walt. (Carolina canarygrass) RRB0753	N/A	May	C
<i>Poa arachnifera</i> Torr. (Texas bluegrass) RRB0273	I/A	April-May	C, FP
<i>P. arida</i> Vasey (plains bluegrass) RRB0283	N/P	May-June	FP

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Taxon, Common Name, and Collection Number <sup>1</sup>	O/H <sup>2</sup>	Flower/Fruit	Habitat Type <sup>3</sup>
<i>Polypogon monspeliensis</i> (L.) Desf. (rabbitfoot grass) RRB0845	I / A	June-Sept	FP, R
<i>Schizachyrium scoparium</i> (Michx.) Nash (little bluestem) RRB0896	N / P	Aug-Sept	GY, GR, C, SS, FP
<i>Setaria parviflora</i> (Poir.) Kerguelen (knotroot bristlegrass)* RRB0837	N / P	May-Sept	GR, C, FP, R
<i>Sorghastrum nutans</i> (L.) Nash (indian grass) RRB0199	N / P	Aug-Sept	GR, SS, FP, R
<i>Sorghum halepense</i> (L.) Pers. (Johnson grass)* RRB0604	I / P	June-Sept	GR, SS, FP
<i>Sphenopholis obtusata</i> (Michx.) Scribn. (prairie wedgescale) RRB0379	N / P	May-Sept	GR, C
<i>Sporobolus compositus</i> (Poir.) Merr. var. <i>compositus</i> (tall dropseed) RRB0797	N / P	May-Aug	FP
<i>S. cryptandrus</i> (Torr.) A. Gray (sand dropseed)* RRB0472	N / P	June-Aug	GY, GR, SS, R
<i>S. texanus</i> Vasey (Texas dropseed)* RRB0200	N / P	May-Sept	GY, GR, C, FP, R
<i>Tridens flavus</i> (L.) Hitch. (purpletop)* RRB0694	N / P	May-Oct	R
<i>T. muticus</i> (Torr.) Nash var. <i>elongatus</i> (Buckl.) Shinners (slim tridens)* RRB0588	N / P	July-Sept	GR
<i>Triticum aestivum</i> L. (common wheat) RRB1472	I / A	May	GR
<i>Vulpia octoflora</i> (Walt.) Rydb. var. <i>octoflora</i> (sixweeks fescue) RRB0743	I / A	May	GR, C
<b>TYPHACEAE</b>			
<i>Typha domingensis</i> Pers. (southern cattail) RRB0495	N / P	June-Sept	R, AQ
<b>ZANNICHELLIACEAE</b>			
<i>Zannichellia palustris</i> L. (horned pondweed) GMC0781	N / P	May	AQ
<b>MAGNOLIOPHYTA-MAGNOLIOPSIDA</b>			
<b>ANACARDIACEAE</b>			
<i>Rhus aromatica</i> Ait. var. <i>pilosissima</i> (Engelm.) Shinners (fragrant sumac) RRB0775	N / S	April-Sept	GY, GR, C, SS, FP
<i>R. glabra</i> L. (smooth sumac) RRB0401	N / S	June-Sept	GY, GR, C, SS, FP
<i>Toxicodendron radicans</i> (L.) O. Ktze. (poison ivy) RRB0779	N / V	May-Aug	C
<b>APIACEAE</b>			
<i>Ammoselinum popei</i> Torrey & Gray (plains sandparsley) GMC0765	N / A	April-July	GR
<i>Cymopterus acaulis</i> (Pursh) Raf. (wild parsley)* GMC0763	N / P	April	GR
<i>Spermolepis inermis</i> (Nutt.) Math. & Const. (spreading scaleseed) RRB0939	N / A	May-June	GR
<b>APOCYNACEAE</b>			
<i>Apocynum cannabinum</i> L. (prairie dogbane) RRB0400	N / P	June	AQ
<b>ASCLEPIADACEAE</b>			
<i>Asclepias asperula</i> (Dcne.) Woodson ssp. <i>capricornu</i> (Woods.) Woods. (spider antelopehorn) RRB0409	N / P	May-June	GR
<i>A. engelmanniana</i> Woods. (Engelmann milkweed) RRB0859	N / P	June-Sept	GY, GR
<i>A. latifolia</i> (Torr.) Raf. (broadleaf milkweed)* RRB0597	N / P	June-July	GR

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<i>A. tuberosa</i> L. (butterfly milkweed)	N/P	June	GR
<i>Cynanchum laeve</i> (Michx.) Pers. (honeyvine)* RRB1276	N/V	July	SS
<b>ASTERACEAE</b>			
<i>Achillea millefolium</i> L. var. <i>occidentalis</i> DC. (western yarrow) RRB0851	N/P	May-Aug	GR, SS
<i>Ambrosia psilostachya</i> DC. (western ragweed) RRB0701	N/P	July-Sept	GR, SS, FP, R
<i>A. trifida</i> L. (giant ragweed) RRB0905	N/A	Aug-Sept	FP
<i>Amphiachyris dracunculoides</i> (DC.) Nutt. (common broomweed) RRB0747	N/A	June-Oct	GR, SS, FP
<i>Artemisia filifolia</i> Torr. (sand sagebrush) RRB0190	N/S	Aug-Oct	GY, GR, SS, FP
<i>A. ludoviciana</i> Nutt. ssp. <i>ludoviciana</i> (white sage) RRB0700	N/P	Sept-Oct	SS
<i>Baccharis salicina</i> Torrey & Gray (groundsel tree) RRB0591	N/S	July-Sept	FP, R
<i>Brickellia eupatorioides</i> (L.) Shinnars var. <i>corymbulosa</i> (Torr. & Gray) Shinnars (false boneset) RRB0932	N/P	Sept	GR
<i>Chaetopappa ericoides</i> (Torr.) Nesom (baby white aster) RRB0307	N/P	April-July	GY, GR
<i>Cirsium ochrocentrum</i> A. Gray (yellow spine prairie thistle) RRB0462	N/P	June-Sept	GR
<i>C. undulatum</i> (Nutt.) Spreng. (wavy-leaf thistle) RRB0459	N/P	June-Sept	GY, GR, SS, FP
<i>Conyza canadensis</i> (L.) Cronq. var. <i>canadensis</i> (horseweed)	N/A	July-Sept	GR, SS, FP, R
<i>Coreopsis tinctoria</i> Nutt. var. <i>tinctoria</i> (plains coreopsis) RRB0846	N/P	June-July	GR
<i>Echinacea angustifolia</i> DC. (blacksamson)* RRB0393	N/P	May-July	GR
<i>Erigeron colomexicanus</i> A. Nelson (running fleabane)* RRB0725	N/B	April-May	GY, GR
<i>E. cf. modestus</i> A. Gray (plains fleabane) RRB0773	N/P	April-May	GR
<i>E. strigosus</i> Muhl. ex Willd. (daisy fleabane) RRB0469	N/A	May-Aug	GR, C, SS
<i>Evax prolifera</i> Nutt. ex. DC. (rabbit tobacco) RRB0187	N/A	Sept	GR
<i>Flaveria campestris</i> J. R. Johnst. (flaveria) RRB0195	N/A	Aug-Sept	R
<i>Gaillardia pulchella</i> Foug. (Indian blanket) RRB0372	N/A	May-Aug	GY, GR, C, SS, FP
<i>G. suavis</i> (A. Gray) Britt. & Rusby (rayless gaillardia) RRB0318	N/P	May	GR
<i>Grindelia papposa</i> Nesom and Suh (wax goldenweed) GMC0783	N/A	Sept	GR
<i>G. squarrosa</i> (Pursh.) Dun. (curlytop gumweed) RRB0918	N/P	Aug-Oct	GY, GR, SS, FP, R
<i>Gutierrezia sarothrae</i> (Pursh.) Britt. & Rusby (broom snakeroot)* GMC0746	N/P	June-Oct	GY, GR
<i>Helianthus annuus</i> L. (common sunflower) RRB0855	N/A	June-Sept	GR
<i>Heterotheca canescens</i> (DC.) Shinnars (hoary false goldenaster) RRB0487	N/P	May-Sept	GY, GR, SS
<i>H. stenophylla</i> (A. Gray) Shinnars (stiffleaf false goldenaster) RRB1274	N/P	May-Sept	GY, GR, SS
<i>Hymenopappus tenuifolius</i> Pursh (slimleaf woolly-white) RRB0389	N/P	May-Aug	GY, GR, SS

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<i>Draba reptans</i> (Lam.) Fern. (white whitlow wort)* GMC0761	N / A	March-April	GY, GR
<i>Lepidium oblongum</i> Small (veiny pepperweed) RRB0293	N / A	May	GR
<i>Lesquerella gordonii</i> (A. Gray) S. Wats. (Gordon bladderpod) RRB0328	N / A	March-June	GY, GR, C
<i>Rorippa nasturtium-aquaticum</i> (L.) Hayek (watercress) RRB0256	I / P	April-July	AQ
<b>CACTACEAE</b>			
<i>Echinocereus reichenbachii</i> (Terscheck) Haage f. (lace cactus) RRB0779	N / P	May	GY
<i>Escobaria missouriensis</i> (Sweet) D.R. Hunt var. <i>similis</i> (Engelm.) N.P. Taylor (Missouri pincushion cactus)*	N / P	May	GY
<i>Opuntia macrorhiza</i> Engelm. var. <i>macrorhiza</i> (plains pricklypear)*	N / P	May-June	GY
<i>O. phaeacantha</i> Engelm. (brownspine prickly pear)* RRB0800	N / P	May-Sept	GY, GR
<b>CAESALPINIACEAE</b>			
<i>Caesalpinia jamesii</i> (Torrey & Gray) Fisher (James' rushpea)* RRB0702	N / P	May-Sept	GR
<b>CAPPARACEAE</b>			
<i>Polanisia dodecandra</i> (L.) DC. (roughseed clammyweed) RRB0504	N / A	June-Sept	GR, C
<b>CAPRIFOLIACEAE</b>			
<i>Symphoricarpos orbiculatus</i> Moench (coralberry) RRB0906	N / S	Aug-Sept	GR
<b>CARYOPHYLLACEAE</b>			
<i>Paronychia jamesii</i> Torrey & Gray (James' nailwort) RRB0403	N / P	May-Sept	GY, GR, SS
<b>CONVOLVULACEAE</b>			
<i>Evolvulus nuttallianus</i> R. & S (hairy evolvulus) RRB0935	N / P	May	GY, GR
<i>Ipomoea leptophylla</i> Torr (ivyleaf morning glory) RRB0489	N / P	June-July	GR
<b>CORNACEAE</b>			
<i>Cornus drummondii</i> Mey. (roughleaf dogwood) RRB0798	N / T	May-Sept	C, R
<b>EUPHORBIACEAE</b>			
<i>Chamaesyce glyptosperma</i> (Engelm.) Small (ribseed sandmat) RRB0881	N / A	July-Sept	GY, GR
<i>Croton lindheimerianus</i> Scheele (threeseed croton)* RRB0888	N / A	July-Sept	GR, SS
<i>C. monanthogynus</i> Michx. (prairie tea)* RRB0642	N / A	July-Aug	GY, GR
<i>C. texensis</i> (Kl.) Muell.-Arg. ex. DC. (Texas croton) RRB0867	N / A	May-Sept	GR, SS, FP
<i>Euphorbia marginata</i> Pursh (snow-on-the-mountain) RRB0655	N / A	July-Sept	GY, GR, C, SS, FP, R
<i>E. spathulata</i> Lam. (warty euphorbia)* RRB0306	N / A	May-June	C, R
<b>FABACEAE</b>			
<i>Amorpha fruticosa</i> L. (false indigo) RRB0501	N / S	May-Sept	FP, R
<i>Astragalus gracilis</i> Nutt. (slender milkvetch) RRB0374	N / P	April-Aug	GY, GR, SS

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<i>A. lotiflorus</i> Hook. (lotus milkvetch) RRB0308	N/P	April-May	GY, GR
<i>A. missouriensis</i> Nutt. (Missouri milkvetch) RRB0739	N/P	April-June	GY, GR, C, SS
<i>A. mollissimus</i> Torr. (woolly loco) RRB0299	N/P	April-July	GY, GR
<i>Dalea aurea</i> Nutt. ex Pursh (golden prairie clover) RRB0848	N/P	June-Sept	GR
<i>D. candida</i> Michx. ex Willd. var. <i>candida</i> (white prairie clover) RRB0479	N/P	June-July	GY, GR
<i>D. enneandra</i> Nutt. (nineanther prairie clover) RRB0478	N/P	June-Sept	GY, GR, SS
<i>Melilotus alba</i> Medikus (white sweetclover) RRB0858	I/A	June-Aug	GR, FP
<i>M. officinalis</i> (L.) Lam. (yellow sweetclover) RRB0764	I/A	May-Aug	GY, GR
<i>Pediomelum cuspidatum</i> (Pursh) Rydb. (tallbread scurf pea) RRB0395	N/P	May-June	GY, GR
<i>Psoraleidum tenuiflorum</i> (Pursh) Rydb. (wild alfalfa) RRB0420	N/P	May-Sept	GY, GR, SS
<i>Sophora nuttalliana</i> B. L. Turner (white loco) RRB0304	N/P	April-June	GR, SS
<i>Vicia ludoviciana</i> Nutt. (Louisiana vetch)* RRB0774	N/A	May-July	GR, SS
<b>GERANIACEAE</b>			
<i>Geranium carolinianum</i> L. (Carolina cranesbill)* RRB0815	N/A	May-July	GR, C, SS
<b>GROSSULARIACEAE</b>			
<i>Ribes aureum</i> Pursh var. <i>villosum</i> DC. (western red currant) RRB0267	N/S	April-July	GR, C, R
<b>HYDROPHYLLACEAE</b>			
<i>Nama stevensii</i> C. L. Hitchc. (Steven's fiddleleaf) RRB0473	N/A	May-July	GY
<i>Phacelia integrifolia</i> Torr. (gyp phacelia) RRB0633	N/A	May-Sept	GY
<b>KRAMERIACEAE</b>			
<i>Krameria lanceolata</i> Torr. (trailing ratany)* RRB0419	N/P	May-June	GR
<b>LAMIACEAE</b>			
<i>Hedeoma hispida</i> Pursh (mock pennyroyal)* GMC0780	N/A	May	GR
<i>Monarda citriodora</i> Cerv. ex Lag. (lemon beebalm)* RRB0847	N/A	May-Aug	GR, SS
<b>LINACEAE</b>			
<i>Linum compactum</i> A. Nels. (Wyoming flax)* RRB0284	N/A	May-Aug	GY, GR
<i>L. lewisii</i> Pursh var. <i>lewisii</i> (prairie flax)* RRB0287	N/A	April-June	GY, GR, SS
<i>L. rigidum</i> Pursh var. <i>rigidum</i> (stiffstem flax)* RB0767	N/A	May-Aug	GY, GR
<b>LOASACEAE</b>			
<i>Mentzelia nuda</i> (Pursh) Torrey & Gray var. <i>stricta</i> (Osterhout) Harrington (bractless blazingstar) RRB0592	N/P	June-Sept	GY, GR, SS
<i>M. oligosperma</i> Nutt. ex Sims (stickleaf mentzelia) RRB0415	N/P	May-Sept	GY, GR, C, SS

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<b>MALVACEAE</b>			
<i>Callirhoe involucrata</i> (Torrey & Gray) A. Gray (cowboy rose) RRB0300	N/P	May-Aug	GY,GR,C,SS,FP,R
<i>Sphaeralcea coccinea</i> (Nutt.) Rydb. (scarlet globe mallow) RRB0410	N/P	April-June	GY, GR, SS
<b>MIMOSACEAE</b>			
<i>Desmanthus illinoensis</i> (Michx.) MacM ex B. L Robins. & Fern. (Illinois bundleflower) RRB0866	N/P	July-Aug	GR, SS
<i>D. leptolobus</i> Torrey & Gray (slenderlobe bundleflower)* RRB0857	N/P	May-Aug	GR
<i>Mimosa borealis</i> A. Gray (fragrant mimosa) RRB0755	N/S	May-July	GR
<i>M. nuttallii</i> (DC.) B. L. Turner (sensitive briar) RRB0390	N/P	May-Aug	GY, GR, SS
<i>Prosopis juliflora</i> (Swartz) DC. (mesquite) RRB0641	N/T	May-Aug	GR
<b>NYCTAGINACEAE</b>			
<i>Mirabilis linearis</i> (Pursh) Heim. (narrowleaf four o'clock) RRB0652	N/P	June-Sept	GY, GR, SS
<b>ONAGRACEAE</b>			
<i>Calylophus berlandieri</i> Spach (Berlandier's sundrops)* RRB1278	N/P	April-Aug	GY, GR, C, SS
<i>C. hartwegii</i> (Benth.) Raven ssp. <i>hartwegii</i> (Hartweg's sundrops) RRB0281	N/P	May-July	GY, GR, SS
<i>C. serrulatus</i> (Nutt.) Raven (yellow sundrops) RRB1471	N/P	April-Aug	GY, GR, C, SS
<i>Gaura coccinea</i> Nutt. ex Pursh (scarlet gaura) RRB0289	N/P	April-July	GY, GR, SS, FP, R
<i>G. parviflora</i> Dougl. ex Lehm. var. <i>parviflora</i> (velvety gaura) RRB0634	N/A	July-Sept	GR, SS
<i>G. villosa</i> Torr. ssp. <i>villosa</i> (hairy gaura) RRB0374	N/P	May-Sept	GY, GR
<i>Stenosiphon linifolius</i> (Nutt. ex James) Heynh. (false gaura) RRB0391	N/P	June-Sept	GY, GR, SS
<b>OROBANCHACEAE</b>			
<i>Orobanche ludoviciana</i> Nutt. (Louisiana broomrape)* RRB0849	N/P	June-Sept	GY, GR
<b>OXALIDACEAE</b>			
<i>Oxalis stricta</i> L. (yellow wood sorrel)	N/P	April-Aug	GR, C
<b>PAPAVERACEAE</b>			
<i>Argemone polyanthemus</i> (Fedde.) G. Ownbey (prickly poppy)	N/A	June-July	GR
<b>PLANTAGINACEAE</b>			
<i>Plantago patagonica</i> Jacq. (woolly plantain) RRB0784	N/A	May-July	GY, GR, SS
<i>P. rhodosperma</i> Dcne. (redseed plantain) RRB0290	N/A	April-June	GY, GR, C
<b>POLYGALACEAE</b>			
<i>Polygala alba</i> Nutt. (white milkwort) RRB0325	N/P	May-Aug	GY, GR
<i>P. verticillata</i> L. var. <i>isocycla</i> Fern. (whorled milkwort)* RRB0653	N/A	Aug	GR

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<b>POLYGONACEAE</b>			
<i>Eriogonum annuum</i> Nutt. (annual eriogonum) RRB0934	N / A	June-Oct	GR
<i>Polygonum pensylvanicum</i> L. (Pennsylvania smartweed) RRB0785	N / A	May	R
<i>Rumex altissimus</i> Wood (pale dock) RRB0401	N / P	May-Sept	R
<b>PORTULACACEAE</b>			
<i>Portulaca pilosa</i> L. (moss rose) RRB0586	N / A	July-Aug	GR
<b>PRIMULACEAE</b>			
<i>Samolus ebracteatus</i> H. B. K. (coast brookweed)* GMC0782	N / P	Nov	R
<i>S. valerandi</i> L. ssp. <i>parviflorus</i> (Raf.) Hulten (water pimpernel) RRB0903	N / A	July-Aug	R
<b>RANUNCULACEAE</b>			
<i>Anemone caroliniana</i> Walt. (Caroline anemone)*	N / P	April	GR
<i>Delphinium carolinianum</i> Walt. ssp. <i>virescens</i> (Nutt.) Brooks (Carolina larkspur) RRB0396	N / P	May-June	GY, GR, SS
<b>ROSACEAE</b>			
<i>Prunus angustifolia</i> Marsh. (Chickasaw plum) RRB0253	N / S	April-July	GY, GR
<b>RUBIACEAE</b>			
<i>Galium aparine</i> L. (catchseed bedstraw) RRB0745	N / A	May-June	C, FP, R
<i>Hedyotis nigricans</i> (Lam.) Fosberg (prairie bluet)* RRB0465	N / P	May-Aug	GY, GR
<b>RUTACEAE</b>			
<i>Ptelea trifoliata</i> L. (hop tree) RRB0771	N / T	May	GR
<b>SALICACEAE</b>			
<i>Populus deltoides</i> Bartr. ex Marsh. (eastern cottonwood)	N / T	Unobserved	R
<i>Salix nigra</i> Marsh. (black willow) RRB0380	N / T	April-June	FP, R
<b>SANTALACEAE</b>			
<i>Comandra umbellata</i> (L.) Nutt. (western comandra) RRB0786	N / P	April-June	GY
<b>SAPOTACEAE</b>			
<i>Sideroxylon lanuginosum</i> Michx. ssp. <i>oblongifolium</i> (Nutt.) T. D. Pennington (chittamwood) RRB0294	N / T	May	GR
<b>SCROPHULARIACEAE</b>			
<i>Agalinis cf aspera</i> (Dougl. ex Benth.) Britt. (tall false foxglove)* RRB0698	N / A	Sept	GR
<i>Castilleja purpurea</i> (Nutt.) G. Don var. <i>citrina</i> (Pennell) Shinnars (prairie paintbrush) RRB0303	N / P	April-June	GY, GR, SS
<i>Penstemon cobaea</i> Nutt (false foxglove) RRB0940	N / P	May-June	GR
<i>P. cf fendleri</i> Torrey & Gray (Fendler's penstemon)* RRB0894	N / P	Aug	GR

\*Taxon not previously reported for Woodward County.

<sup>1</sup>RRB= Robin R. Buckallew, GMC=Gloria M. Caddell.

<sup>2</sup>O=Origin, H=Habit, N=Native, I=Introduced, P=Perennial, A=Annual, B=Biennial, V=Vine, T=Tree, S=Shrub.

<sup>3</sup>GY=Gypsum, GR=Grassland, C=Cave, SS=Sandsage, FP=Floodplain; R=Riparian, AQ=Aquatic.

Appendix 1 (contd): Taxa present at the SLL, with origin (native, introduced), habit (annual, biennial, perennial, tree, shrub or vine), flowering and fruiting dates, and habitat (aquatic, cave entrance, floodplain, grassland, gypsum outcrop, riparian, sandsage grassland).

Taxon, Common Name, and Collection Number <sup>1</sup>	O/H <sup>2</sup>	Flower/Fruit	Habitat Type <sup>3</sup>
<b>SOLANACEAE</b>			
<i>Chamaesaracha coniodes</i> (Moric. ex Dun.) Britt. (chamaesaracha) RRB0936	N / P	April-May	GR
<i>Physalis cf. angulata</i> L. (cutleaf groundcherry) RRB0925	N / A	Sept	C
<i>Solanum elaeagnifolium</i> Cav. (silverleaf nightshade) RRB0412	N / P	May-Sept	GR, SS, FP
<i>S. rostratum</i> Dun. (buffalobur) RRB0488	N / A	May-Sept	GY, GR, SS
<b>TAMARICACEAE</b>			
<i>Tamarix chinensis</i> Lour. (saltcedar) RRB038	I / S	May-Sept	GY, GR, FP, R
<b>ULMACEAE</b>			
<i>Celtis laevigata</i> (Willd.) var. <i>reticulata</i> (Torr.) L. Benson (netleaf hackberry)	N / T	Unobserved	GY, GR
<i>Ulmus americana</i> L. (American elm) RRB0723	N / T	March-April	GY, R
<b>URTICACEAE</b>			
<i>Parietaria pensylvanica</i> Muhl. ex Willd. (pennsylvania pellitory) RRB0882	N / A	May-Aug	C
<b>VERBENACEAE</b>			
<i>Verbena bracteata</i> Lag. & Rodr. (big bract verbena) RB0871	N / A	May-Sept	GY
<b>VIOLACEAE</b>			
<i>Viola bicolor</i> Pursh (johnny-jump-up)* RRB0269	N / A	April-May	C
<b>VITACEAE</b>			
<i>Cissus trifoliata</i> (L.) L. (possum grape)* RRB1275	N / V	June-Sept	R
<i>Vitis riparia</i> Michx. (riverbank grape) RRB0295	N / V	May-Aug	GR, C, R
<b>ZYGOPHYLLACEAE</b>			
<i>Tribulus terrestris</i> L. (goathead)* RRB0920	I / A	Sept	GR

\*Taxon not previously reported for Woodward County.

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